



Linköping university - Addressing the Digital Transformation

Johan Ölvander, dean, Faculty of science and

AGENDA

- Linköping University – who we are
- Digital transformation
 - How we contribute to the digital transformation in society
 - Research projects and collaboration
 - Education
 - How we as an organisation try to embrace the digital transformation
 - Digital transformation in the organisation
 - Ongoing internal projects

This is Linköping University

- Established in 1975
- 35,000 undergraduate students
- 4,000 employees
- Turnover 4.000 million SEK



Faculty of Science and Engineering

- Founded in 1969
- One of the top 5 Swedish higher education institutions for engineering and natural science
- 14,000 students in Engineering
- 600 PhD students (100 PhD exams/year)
- 600 faculty including 150 professors.
- Budget 2021 approximately 1700 MSEK
 - 650 MSEK education
 - 400 MSEK faculty funded research
 - 650 MSEK externally funded research

Research (60%) > education (40%)
Externa funding (60%) > government grants (40%)



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WASP

WALLENBERG AI,
AUTONOMOUS SYSTEMS
AND SOFTWARE PROGRAM



CHALMERS



LINKÖPINGS UNIVERSITET



LUNDS
UNIVERSITET



UMEÅ
UNIVERSITET

Vision

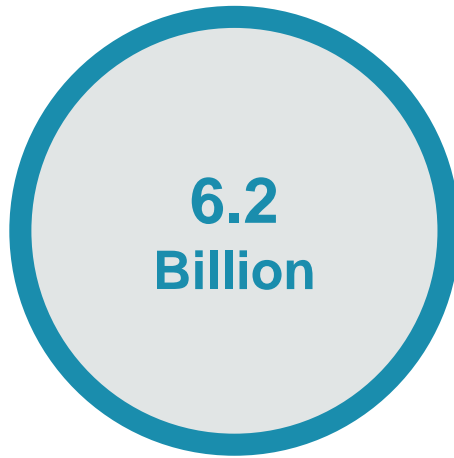
Excellent research and competence in artificial intelligence, autonomous systems and software for the benefit of Swedish society and industry.

Mission

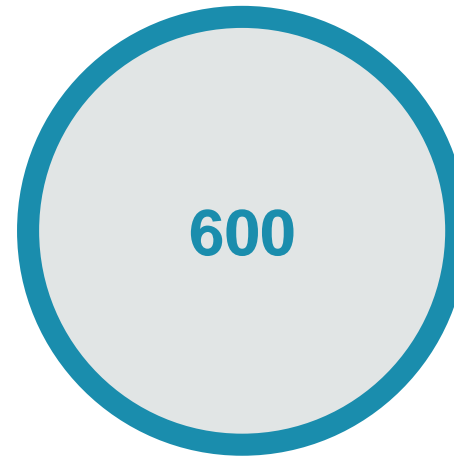
Build a platform for world class academic research that interacts with leading companies and actors in Sweden to develop knowledge and competence for the future.

*Knut och Alice
Wallenbergs
Stiftelse*

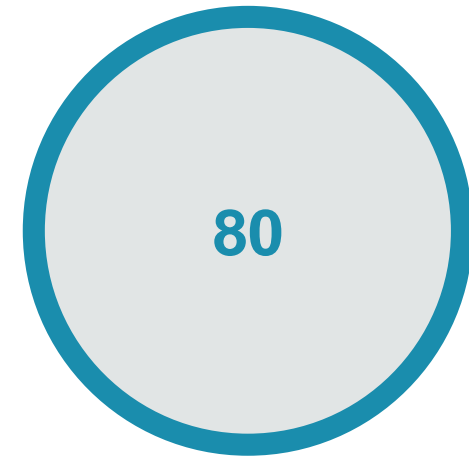
WASP in Numbers



**6.2 billion SEK for
16 years until
2031**



**600 Graduated
PhDs**



**80 Faculty
Recruitments**

Societal impact and industrial collaboration

- 80 companies and agencies engaged in WASP
- Goal to examine 150 Industrial PhDs
- Research arenas
 - Two scenario driven arenas: Public Safety and Robotics
 - Two technology driven arenas: Ops and Media & Language

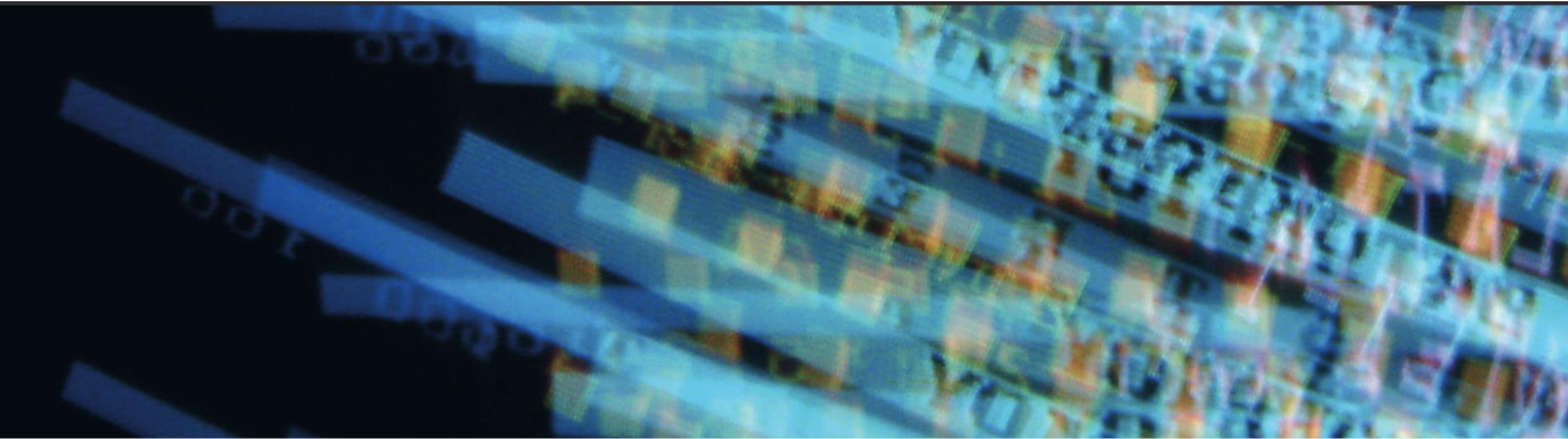


Photo: Thor Balkhed, Linköping University



ELLIIT

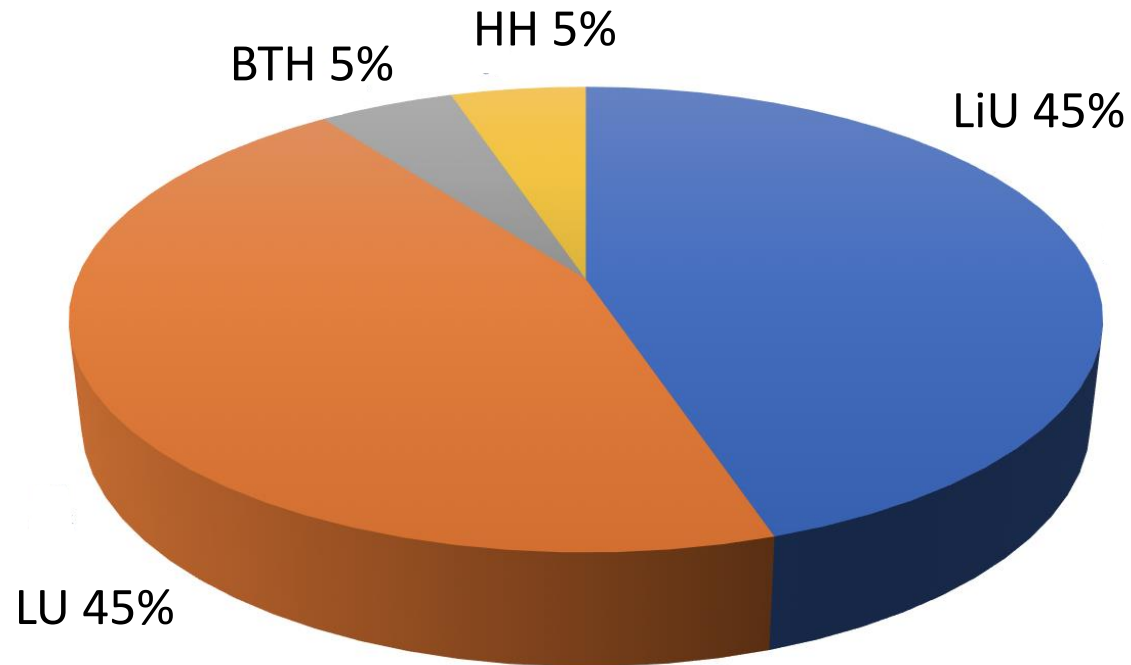
Excellence Center at Linköping – Lund
in Information Technology



ELLIIT - the leading national environment for basic and applied research in IT and mobile communications

ELLIIT: a Strategic Research Environment in IT and Mobile Communications

- > 100 MSEK financial support annually
- Founded by the Swedish Government in 2010
- A partnership between Linköping University, Lund University, Halmstad University and Blekinge Institute of Technology



LUND
UNIVERSITY



Research and collaborations

- Digitalization is reflected in all our research projects, from small individual projects to large research programs.
- Digital transformation is best targeted in collaboration with partners from society (industry), as well as academic partners.
- Our large research programs in the area highlights the strengths of collaboration and partnerships including both academic and industrial partners and where mobility is a crucial component.



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 - **Education**
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Digital transformation in education

- Traditionally we are a campus-based university.
 - 90% of our revenue comes from our on-campus students.
 - We see ourselves as a campus-based university also in the future
- Today our growth is exclusively based on our distance-based courses.
- Our most successful distance-based courses are targeting digital transformation and Life-Long-Learning.
- Example of successful courses include:
 - Elements of AI (>3000 students/year), Cyber security (>1000 students/year), Elements of AI part II, Basic of machine learning, AI for natural language, etc.
 - **Characteristics:** The courses are small (few ECTS), they are though asynchronous, the examination ratio is lower compared to campus-based courses
 - **Positive impact:** The courses are good for LLL as well as our traditional students, boosts our brand value, good for collaboration, we do make good money on these courses!

Transformation of on-campus education

- The three latest additions to our program offering
 - MSc in Data-driven development (5-year program)
 - MSc Cyber security (2-year program)
 - MSc Digital Construction Management (2-year program)
- Review of digitalization components in our existing programs:
 - digital subjects in relation to the field of study
 - tools and methods (digital literacy)
 - pedagogy (efficient usage of digital teaching)
- Closure of old programs
 - We have a hard time to close down old programs or do major reconstructions.



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The background image is a composite. The left side shows a close-up, shallow depth-of-field shot of a computer monitor and keyboard on a desk. The right side is a darker, semi-transparent overlay containing text, with a faint image of a person's hands using a computer mouse visible behind it.

Campus of the Future

LiU Business plan directive

- Deliver a set of future projects and processes for the development of a “digital campus”
- Working group of teachers, supporting IT-staff and students.
- Meetings, workshops, creations etc.
- Resulting in 4 projects

Digital confidence

- LiU needs to work broadly with the aim of creating digital self-confidence among our employees and students
- **Digital knowledge lift**
 - Aims to increase the competences and skills of students and staff needed to confidently use digital services to their full potential
- **Pedagogical digital competence**
 - Aims to increase the teacher's pedagogical digital competence



Digital companion

- The digital companion is designed to help students and employees to cope with their everyday tasks more easily and efficiently. This can be in the form of reminders to more competent encouragement or coaching
 - Step 1 – Aggregated notifications (underway)
 - Step 2 – Personal digital assistant
 - Step 3 – Role-based digital assistants
 - Step 4 – Digital coach
- Requires development of the basic infrastructure to create capabilities for data-driven decision-making



Future meeting places

- The project develops attractive campus environments where the physical and the digital worlds are interwoven in the meeting places of the future.
 - Open arenas for meetings, where simulation, labs, visualization etc. are included.
 - Digital mirrors, "peepholes" between campuses.
 - Virtual Reality (VR) or Augmented Reality (AR) in order to supplement the physical environment in teaching research and collaboration.



Innovative living labs

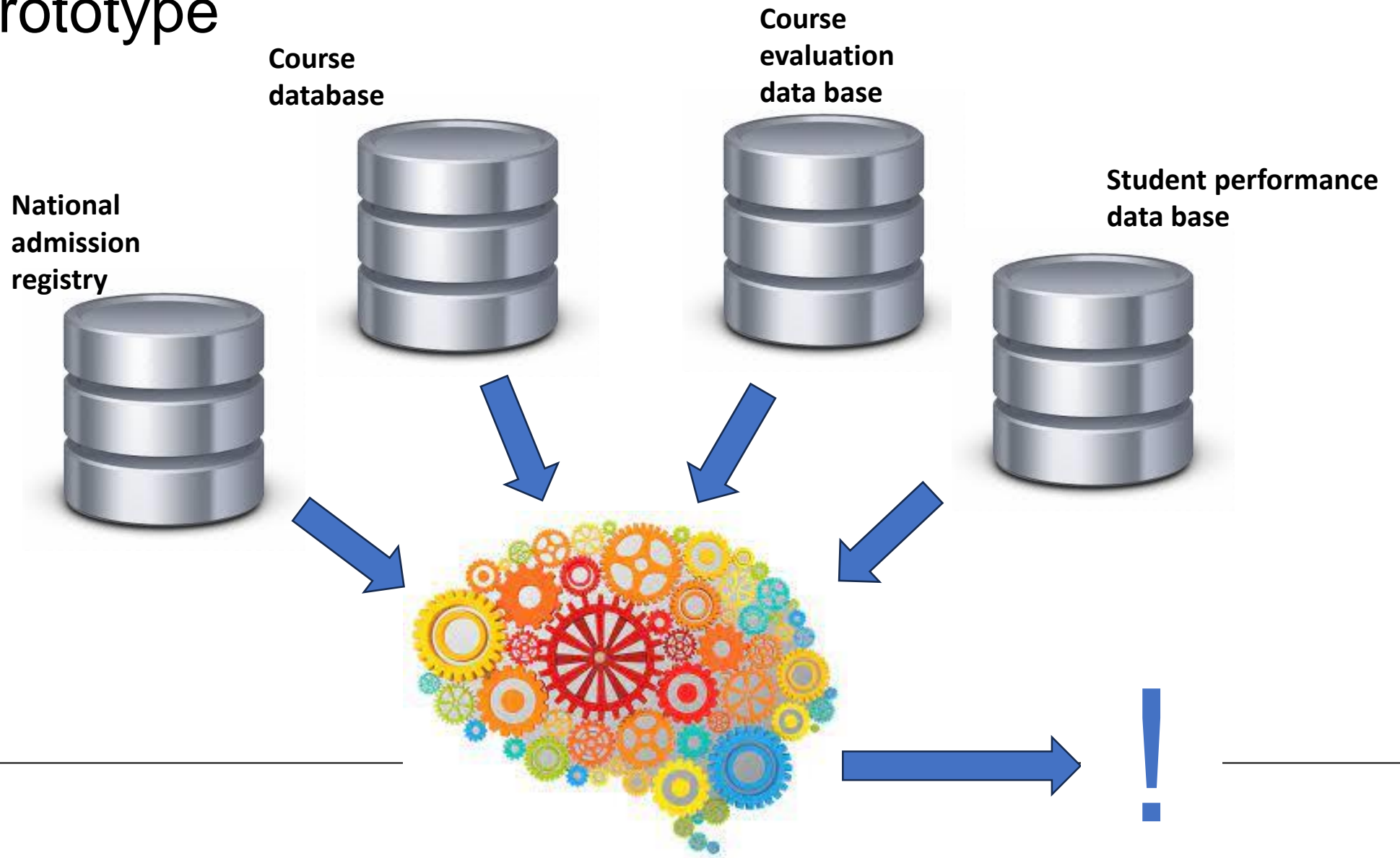
- Identify large or small projects that, based on the possibilities of digitization, improve operations for researchers, teachers and/or students
- In an Innovation lab, employees with knowledge of needs and the possibilities of technology meet to develop and test ideas together
- Good and inspiring examples are created, made visible and spread through various projects and initiatives



Data-driven operations supporting education development

- How can we be more data-driven when analysing and supporting our education development?
- How are the students coping with their studies?
- What are the bottle necks of the educational programs?
- How long does it take our students to get their final degree?
- How do our different programs compare to each other on the issues above?
- What are the underlying reasons for the issues above?
- What data, infrastructure and analysis competences are needed to answer the questions above?

Data-driven operations supporting education development - A rough prototype



Program panel – data for the first 6 semesters

Civilingenjörsprogrammet i			maskinteknik								
			Evaluate		Kursresultat			Termin-medel			
			Frekvens	Medelbetyg	Andel GK	Godkänd	Ej godkänd	Frekvens	Betyg	Andel GK	Antal
T1	TATB01	Matematisk grundkurs	33%	4,2	70%	78	34	31%	3,2	72%	112
	TMPR02	Maskinteknisk ing...	39%	3,3	84%	98	19				
	TATA67	Linjär algebra	25%	2,6	68%	75	36				
	TDDE54	Programmering och proble	37%	2,6	85%	92	16				
	TMMV04	Termodynamik	20%	3,5	55%	61	50				
T3	TMHL22	Hållfasthetslära	18%	3,1	43%	49	65	23%	3,6	60%	104
	TATA69	Flervariabelanalys	13%	3,5	30%	30	69				
	TMPS34	Tillverkningsteknik	52%	3,2	86%	88	14				
	TMKM12	Konstruktionsmaterial	17%	3,4	69%	71	32				
	TMME28	Mekanik - dynamik	14%	4,6	72%	73	28				
T5	TMEL08	Eltekniska system	17%	3,1	84%	87	16	21%	3,9	90%	105
	TMHL63	Introduktion till beräkning	14%	4,1	94%	100	6				
	TMKM14	Industriella materialval	21%	3,4	99%	105	1				
	TSRT19	Reglerteknik	20%	3,8	81%	85	20				
	TMKT39	Maskinelement	35%	4,9	90%	95	10				
7% T2	TATA41	Envariabelanalys 1	14%	4,0	51%	54	51	13%	4,1	71%	106
	TKMJ24	Miljöteknik	17%	4,2	94%	100	6				
	TMMT04	Experimentell maskinteknik	15%	4,3	97%	105	3				
	TATA42	Envariabelanalys 2	11%	3,7	30%	31	74				
	TMME63	Mekanik - statik	9%	4,6	80%	84	21				
T4	TAMS11	Sannolikhetslära och statist	9%	3,3	78%	76	22	12%	3,7	81%	99
	TMMV11	Strömningslära och värmeö	18%	3,3	76%	78	24				
	TMKA02	Konstruktionsmetodik och	12%	3,9	96%	94	4				
	TKMJ24	Miljöteknik	13%	3,8	86%	84	14				
	TMHL24	Hållfasthetslära - Dimensior	8%	4,3	70%	71	30				
T6	TMMS21	Mekatronik	18%	3,2	95%	98	5	18%	3,8	91%	103
	TPPE91	Produktionssystemets plan	25%	4,2	86%	88	14				
	TMMT31	Kandidatarbete maskintekn	11%	3,9		102	1				
Medelvärde:								20%	3,7	77%	105

Faculty panel – all our 5-year programs in one table

			Överblick T1 till T6				Kandidatarbeten VT23					Exjobb VT23			
		Nom. ant.	Medel från programpanel					Orginalkull-studenter		Kullen			Kullen		
Nämnd	Program	platser	Antal studenter	Evaluat-frekvens	Evaluat-medeletyg	Andel FFG-GK	Startade HT20	Antal	Andel	Antal	Andel	Startade HT18	Antal	Andel	lägsta BI in
DM	D	90													
	U	60													
	IT	30													
	MT	60													
EF	Y	90													
	ED	20													
	MED	30													
IL	I	180													
	KTS	20													
KB	KB	40													
	TB	30													
MD	M	120	105	20%	3,7	77%	132	93	70%	103	78%	138	96	70%	
	EMM	60	61	26%	3,8	80%	71	53	75%	59	83%	79	62	78%	
	DPU	90	89	19%	3,8	78%	114	83	73%	89	78%	68	48	71%	

			Examensfrekvens inom nominell +1 år						Examensfrekvens inom nominell +3 år					
				Original-kullstudenter		Kullen				Original-kullstudenter		Kullen		
Nämnd	Program	Nom. ant. platser	Startade HT17	Klara	Andel	Antal	Andel	lägsta BI in	Startade HT15	Klara	Andel	Antal	Andel	lägsta BI in
DM	D	90												
	U	60												
	IT	30												
	MT	60												
EF	Y	90												
	ED	20												
	MED	30												
IL	I	180												
	KTS	20												
KB	KB	40												
	TB	30												
MD	M	120	130	74	57%	90	69%	18,4	138	97	70%	125	91%	19,1
	EMM	60	69	37	54%	42	61%	18,8	73	49	67%	64	88%	19,9
	DPU	90	61	39	64%	47	77%	19,1	63	43	68%	60	95%	19,5

Conclusions

- In our research we are developing state of the art methods and tools for AI, decision-making, data-driven design, digital-twins, visualizations etc. and we also apply these successfully together with industrial partners.
- In our own operations we are just starting to work towards data-driven operations eg. in our education development.
- The “Digital companion” and “Data-driven operations” are two projects targeting this area, fishing in the same data pool.
- We (and maybe also many other universities), need to better Walk the talk!
- National and international projects are ongoing in the area, e.g. common data formats, common platforms etc.
- Large potential to speed up this development!



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